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ABSTRACT

Changing patterns in how students apply to colleges and universities have affected the way institutional researchers project enrollment. This paper explores the usefulness of adding student prematriculation activities (i.e., commitment to enroll, registration patterns, and academic ability). Trends in prematriculation activity identified include increased student time investment in the college choice process, increased amount of information available to students, and increased numbers of applications sent out by each student. Admission trends have reflected these changes in record numbers of applications, declines in first year enrollments, more acceptances offered by colleges, but fewer students enrolling in their first choice of college. The data for this study were freshmen from 1991 to 1995 at Indiana University-Bloomington who were counted at four different times in the enrollment process. Findings indicated that although fewer students paid the enrollment deposit by May 1, 88 percent of those who did registered for classes in July. Numbers of students registering in July added significantly to the accurate prediction of fall enrollment as did student Scholastic Assessment Test scoree and high school rank. (DB)

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The effect of prematriculation activity on freshman enrollment:

Guess who's coming and guess who's staying.

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Jean Endo
Editor
AIR Forum Publications

Changing patterns in how students apply to colleges and universities have affected the way institutional researchers project enrollment. This paper explores the usefulness of adding student prematriculation activities (i.e., commitment to enroll, registration patterns and the relationship to academic preparation) to projection models. Understanding freshman enrollment patterns is key for a variety of campus activities such as budgetary planning, course demands and retention issues.

Introduction

College choice is no longer the straightforward process it was ten or fifteen years ago; in fact, it is becoming more of an exacting science. Students are applying to more universities, vying for financial aid, assessing the quality of education using a variety of resources, and assessing the marketability of their anticipated degree, all of which are time consuming endeavors. While students are taking time to become more knowledgeable about educational institutions, application deadlines and registration periods take on secondary importance. Consequently, predicting which of the admitted applicants will matriculate is becoming a greater challenge while the need for more accurate predictions is increasingly critical for university planning.

During the early 1990's there were record low numbers of high school graduates (now beginning to increase). However, universities and colleges were experiencing record numbers of applications (McDonough, 1994), illustrating a distinctive shift in how students are now approaching the college decision process. These applications have not been good predictor of freshmen enrollment since many universities are experiencing lower yields from their applications (Sanoff, 1994). Some universities have recognized the changing patterns of student applications and no longer admit the most qualified students assuming that most students may have applied to institutions with a higher ranking and will be accepted. This allows the university to accept students who are likely to attend without holding spaces for students not likely to enroll (Gose, 1995). While admission practices have been affected by these trends, institutional researchers also need to be aware of how these trends affect enrollment patterns.

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Trends in Prematriculation Activity

High school students commit over 50 hours of time (excluding campus visits) and $1,500 investigating and gathering information on colleges and universities (Galotti and Mark, 1994). Galotti also found that students of higher academic ability (determined by high school GPA, high school rank, and standardized test scores) tend to start their college choice process earlier; they research and apply to a greater number of schools.

A direct consequence of the increase in student information gathering is the expanded market for college choice information. Prospective high school students now have a wealth of information and resources available to them to aid their college decision-making. These resources include parents and guardians, friends, college brochures and catalogues, guidance office materials, private counselors and consultants, college guidebooks, CD-ROMs, and the Internet. Parents and guardians are generally the starting point in the college choice process, students will seek their advice, due mainly to the finances the family incurs when a child is attending a higher education institution. Students also rely on information they obtain from friends and former classmates who are enrolled in a college or university (Galotti and Mark, 1994).

High school students are requesting more brochures and catalogues from colleges and universities in an effort to learn as much as possible about academic programs and course offerings, as well as housing, financial aid, school size, and extra-curricular activities. Students are also curious about the social climate of the institution and the surrounding community. Since students are requesting more information, marketing efforts have been expanded by college admissions offices.

Previously, much of the effort put forth by students in procuring information about colleges centered around a visit to the high school guidance counselor's office. Due to economic cutbacks, many public high schools have diminished the functions of the guidance office, sometimes even eliminating the operation completely. The current average ratio of guidance counselor to public high school students is one to 325, while in larger U.S. cities, the ratio is even more extreme: one to 740 (McDonough, 1994). Because of this lack of individual student attention, many families are turning to private counselors and consultants, which can generally

offer package deals which include SAT preparation, essay writing, application responses, and college program searches.

Colleges and universities are also competing for quality freshmen as an academically prepared freshmen class has a direct impact on retention and graduation rates. Circularly, prospective students evaluate institutions based on these retention and graduation rates. Parents and students are placing greater importance on ratings and "best buys" when searching for an institution to fit their needs. Guidebooks and rankings from such sources as Peterson's, U.S. News and World Report, and Money Magazine, are selling in large volumes and also creating controversy (McDonough, 1994). Institutions are trying to find ways to effectively market themselves in these guides as students place higher importance on them.

With the increased competition for students and enhanced marketing efforts by colleges, many colleges are offering students CD-ROMs which are used in lieu of actual campus visits. These CD-ROMs give the student a feel for the campus and its operations without the student having to set aside a great deal of money and time to make a campus visit (Galotti and Mark, 1994). While CD-ROMs help students narrow their choices, students continue to rely on campus visits.

As the information highway continues to explode and provide more information, it also becomes an excellent resource for high school students who are investigating their college options. Due to a variety of funding and research efforts, there is a very high percentage of academic institutions with information available on the Internet and the World Wide Web. Competition and marketing are on the increase among colleges and as web sites are continuously updated and made more user-friendly, students will employ these electronic mediums more frequently.

Not only are students educating themselves more in their college decision making, they are also increasing their chances of getting into the college of their choice by sending out more applications. The table below illustrates how the number of applications sent has changed over the years (Day, et al. 1991):

Table 1: Percentage of Students Sending One or More Applications by Year

	1969	1984	1994
One	51.3%	34.9%	32.1%
Two	20.0%	17.8%	15.3%
Three	13.8%	17.4%	16.6%
Four or More	14.9%	29.8%	36.0%

The percentage of students sending four or more applications to colleges increased from 14.9 percent to 36.0 percent over a 25 year period, while those sending only one application has dropped from 51.3 percent to 32.1 percent. Students are more willing to apply to more prestigious institutions and are willing to invest extra money for the multiple applications reasoning that the effort is worth it given the increasingly higher cost of education (Shea, 1994). Along the same lines, students will also pay the enrollment deposit at one college while waiting to hear from another. To these students, this enrollment deposit is a small investment to assure themselves of a college acceptance, while waiting for a more preferred choice.

Examining the behavior of students before they apply and matriculate is one element that can help shape enrollment models for institutions. Other aspects that need to be considered are the trends taking place in admissions practices.

Admission Trends

In recent years, colleges and universities have seen record numbers of applications. Ivy league and private institutions have seen the largest increases: Harvard, up 10 percent, Yale, up 21 percent, University of Notre Dame, up 21 percent, all in 1994 (Shea, 1994). In 1995, Indiana University saw a significant jump of 3.1 percent in the number of applications received, while other Big Ten institutions' increases ranged from two to eight percent. However, this influx of applications has not guaranteed increased enrollment and yield rates for institutions. Between 1985 and 1992, there have been declines in first-time enrollments for four-year

institutions. Also, the yield rates have decreased dramatically over the past several years (Breland, et al. 1995). These decreasing yield rates could be an indication that the enrollment deposit is becoming less of a consistent indicator of actual enrollment.

To combat the decreasing yield rates, colleges are accepting more students in an effort to maintain enrollments. The table below illustrates the number of college acceptance notices students have reported receiving (Dey, et al. 1991).

Table 2: Percentage of Students with the Number of College Acceptances Received

	1979	1984	1989
One	24.1%	18.9%	16.3%
Two	28.6%	28.3%	25.9%
Three	22.3%	23.5%	23.8%
Four or More	24.9%	29.2%	34.1%

Students receiving only one acceptance from a college or university has decreased from 1979 to 1989, while the percentage of students who have received four or more acceptances has significantly increased over this same time period.

Despite the increase in the number of acceptances, fewer students are attending the college that was their first choice. This indicates that students are 'shopping around' more for the college of their choice. The table below illustrates how the percentage of students attending the 'college of their choice' has changed over several years (Dey, et al. 1991).

Table 3: Percentage of Students attending their College of Choice

	1979	1984	1989
1st Choice	75.6%	73.3%	68.9%
2nd Choice	18.5%	20.4%	22.9%
Other	5.9%	6.3%	8.3%

Students are more willing to apply to more highly competitive schools than they were in past, therefore a lower percentage of students are attending their first choice of college. With students applying to more colleges, many of their first choices have switched from a college where the likelihood of acceptance was high to a college where the likelihood of acceptance is lower, but the quality or reputation of an educational institution was better. Again, with the cost of education on the rise, families are trying to get the best their money can buy, therefore families are shopping around for the best colleges and financial aid packages.

Not only do admissions offices have to struggle with these changing trends in the application process, they also need to ensure they are accepting a consistent quality of student, an issue that affects future enrollment patterns due to retention and graduation rates. Lower rates affect university budgets due to inconsistent enrollment trends; these low rates affect the reputation of the university portrayed in guidebooks (thus affecting future enrollments). Therefore, admission offices place significant emphasis on admission criteria such as high school GPA, admissions test scores (the SAT and the ACT), high school course work, and letters of recommendation (Breland, et al. 1995). These criteria, along with the other prematriculation behaviors of students, add to the difficulty of predicting enrollment.

While admissions offices have many issues to address with these changing trends, institutional researchers are also scrambling to explain current registration patterns and fluctuating enrollment figures. Formerly, prematriculation activity was more stable. In recent years, there have been fewer high school graduates creating a "buyers market" leading to an increase in college marketing efforts. This environment has precipitated an increase in student applications in an effort to get the best buy for their money. The combination of these two factors has made it difficult to predict who will be enrolling in the fall. The purpose of this study is to identify variables that may reveal prematriculation behaviors and test their usefulness as predictors of enrollment, given the college choice process under which students are now operating. Enrollment projection models that rely on stable application behaviors need to be updated with new predictive models incorporating these new trends. While the purpose of this study is not to develop a model predicting enrollment, a model will

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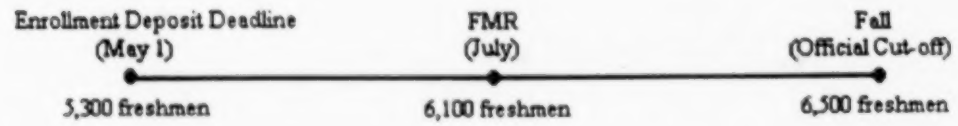
be developed to test the usefulness of the available prematriculation behaviors. Should the readily available prematriculation behaviors serve as effective sources of information, student behaviors available from other offices, such as financial aid or admissions offices, will be solicited for future investigation.

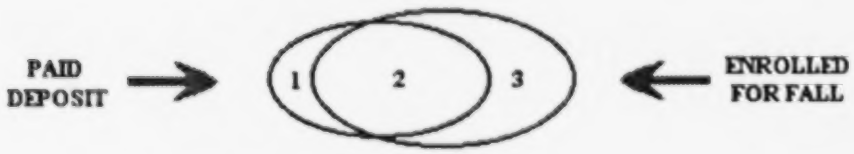
The Data

The data for this study are freshmen from 1991 to 1995 at Indiana University-Bloomington. Students are added to the database at four different points in time: at May 1, which is the deadline for the enrollment deposit; at the end of freshman registration in July; on the first day of classes and at the official reporting period. At each time period, data fields such as hours enrolled, enrollment status and student demographics are added and/or updated. The term freshmen is an anticipated class standing for the upcoming fall semester, since some students in the data base did not matriculate. One of the strengths of this database is the flexibility to simulate the information known at specific points in time (information comes in about prospective students at various times). Three points in time were selected for this study, May, July and the fall official cut-off. Separate analyses were performed at each period. The analysis from the official reporting cut-off, gives an overview of the data for explanatory purposes. The two other periods were selected due to the information that is available at that time and the likelihood of responding with reliable enrollment estimates at that point in time. The following figure shows the average size of an anticipated (enrolled or not enrolled) freshman class at each time period.



Fall Analysis

Predictions for fall enrollment are often requested long before reliable estimates can be made. To understand how the prematriculation behaviors affect fall enrollment status, an overall analysis was performed utilizing all of the available data and variables (including prematriculation variables). The following diagram illustrates three populations that are initially being examined for changes over time. The sections labeled 1and 2 illustrate the students who paid the enrollment deposit and the sections labeled 2 and 3 represent students who enrolled for the fall semester. Thus, portion 2 represents students who both paid the deposit and enrolled for the fall semester.



- **1 Paid Deposit/Not Enrolled**
- **2 Paid and Enrolled**
- **3 Not Paid and Enrolled**

Fewer students are paying the enrollment deposit and more students are enrolling who have not paid the deposit. The following table shows that the percentage of students who enrolled but did not commit by paying the deposit has increased from 15.7% in 1991 to 19.6% in 1995 while the percentage of students in sections 1 and 2 show declines (students who paid the deposit).

Table 4: Freshmen from 1991 to 1995 by Group

	1991	1992	1993	1994	1995
Not Enrolled/Paid Deposit-1	421	482	382	348	314
	6.6%	7.1%	6.0%	5.3%	5.1%
Enrolled/Paid Deposit-2	5,004	5,114	4,973	4,865	4,653
	77.8%	75.5%	77.5%	73.7%	75.4 %
Enrolled/Not Paid Deposit-3	1,007	1,180	1,064	1,387	1,207
	15.7%	17.4%	16.6%	21.0%	19.6%

Despite the decline in the percentage of students who paid the deposit, those students who do pay the deposit are likely to enroll. Of the students who paid the enrollment deposit, the percentage who enroll has increased slightly from 92.2% in 1991 to 93.7% in 1995. This data suggests that by May a fairly high percentage of students who have paid the deposit will enroll, however, predicting enrollment by May becomes more difficult due to those students who enroll but do not pay the deposit.

An examination of SAT scores for students represented by these three groups shows that group 2 (students who enroll and pay the deposit) have a significantly higher SAT composite score than groups 1 and 3. While students in group 3 (students who do not pay the deposit, yet enroll) have lower SAT scores than group 1 (students who paid the deposit and did not enroll.), this difference is not significant. However, a high percentage of students in group 3 did not report SAT scores (this will be discussed again later).

Determining how this data affects enrollment projections can be examined in several ways. First, an analysis predicting fall enrollment using all of the available data and all of the available variables was performed. This analysis provided an actual summary of the relationship between enrollment and the variables historically.

Predicting enrollment in the fall included prematriculation variables such as paid the deposit, registered during freshmen registration in July, first-time or transfer student, registered as a full-time student in July, plus other variables such as gender, ethnic, SAT scores, residency, and high school rank. This model was run for each

semester separately. For each semester, registration at freshmen registration was the first variable to enter the prediction model (using a stepwise procedure). The only other prematriculation variable that significantly contributed to any of the models was type of student (first-time or transfer student).

These preliminary analyses suggest that 1) the majority of students who pay the deposit enroll, but the deposit does not significantly contribute to predicting fall enrollment, 2) academic preparation does add unique information to the model and 3) after freshmen registration, enrollment may be predicted with greater power. The questions now become not only how many students are coming in the fall but also when can we determine how many students are coming (guess who's coming and when). The following section shows models developed for the May 1 deadline and after Freshmen Registration.

Analysis of Deposit and Freshmen Registration

Two subsamples of this total database were selected: 1) PAID = freshmen who paid the enrollment deposit by May and 2) Freshmen Registration = includes freshmen from the PAID population and includes freshmen who enrolled for fall during freshmen registration (FMR) in July. The following table shows the distribution of students for the past five years.

Table 5: Freshmen who paid the deposit or registered during FMR from 1991 to 1995

Freshmen	1991	1992	1993	1994	1995
PAID the Deposit	5,425	5,596	5,355	5,213	4,967
PAID and/or Enrolled during Freshmen Registration (FMR)	6,112	6,428	6,114	6,148	5,792

Predicting Fall Enrollment at May 1

A logistic regression was performed on each of the five fall semesters using the following variables: High School Rank, SAT-Verbal, SAT-Math, Gender, Minority Status, Residency, Metropolitan Indiana County,

and all second order interaction terms. Each semester was evaluated for variables that generated significant parameter estimates. Variables that contributed significantly to the models from 1991 to 1994 were High School Rank, Indiana County, Gender, Minority, Residency, High School Rank by Residency, High School Rank by Gender, High School Rank by SAT-Verbal, High School Rank by SAT-Math, Residency by SAT-V, Gender by SAT-V, High School Rank by Minority, and Minority by Residency. These variables were selected across all of the years, except for 1995 since the model was tested against this data.

The model was tested against the 1995 data in two ways: 1) using the parameter estimates generated from each of the significant variables using data from 1991 through 1994 and 2) using the parameter estimates from the 1994 data. The assumptions are 1) the current year's data can be best modeled by looking at the previous four years or 2) the current year's data can be best modeled by looking at the previous year. Using these parameter estimates, each subject in the 1995 cohort was assigned two predicted probabilities of enrollment (one for each model).

The criteria for predicting enrollment status from the probability values was set at two different cut-offs. For the 1991-1994 model, the actual percent of students who did not enroll was averaged over these semesters. This percent was then used as a rank from which the predicted probability value was selected (once again, assuming the percentage of students who do not enroll will be the same as it was for the previous four years). This predicted probability value represents the lowest value in the predicted to enroll category. Students with a predicted value equal to or lower than this value were considered not likely to enroll. For the 1994 model, the percent not enrolled for 1994 was used as the target rank for selecting the cut-off predicted probability value.

The success of the two models was determined by examining the percentage of misclassified students. Heavier emphasis was placed on reducing the number who were predicted to enroll but did not (i.e., it is more desirable to predict that a student will not enroll and they do enroll than it is to predict that a student will enroll and they do not). If a retention effort is made towards retaining as many of these students as possible to the first week of classes, it is most important to identify students who may not enroll. The models predicting enrollment

at May 1 using the available variables are significant, yet not powerful estimates. Both models predict that nearly 280 students will enroll and they do not enroll (the least desirable prediction).

Predicting Fall Enrollment after Freshmen Registration

The previous analysis suggests that May was too early to predict enrollment, but the fall data suggests that after FMR the projections may be more promising. The steps for this analysis were the same as the first analysis (see summary of steps below):

1. Perform a Logistic Regression using all possible variables and their second order interactions.
2. Make a grid for each year showing the variables that contributed significantly to the model.
3. Run two logistic regression models using all the variables identified in step 2, discard the significant variables from 1995. Parameter estimates are generated from
    a) the 1991 to 1994 data combined
    b) the 1994 data
4. Use the parameter estimates generated from step 3 to predict enrollment status in 1995
5. Determine the average percent who did not enroll from 1991 to 1994 and the percent who did not enroll from 1994 alone. Use these percentages as ranks.
6. Rank order the predicted probability values generated from step 4. Select the probability values that fall at the ranks identified in step 5. Define predicted enrollment as the probability value equal to or greater than this established cut-off
7. Determine success of the predicted values against the actual status of enrollment.
8. Determine the best model.

The contributing variables used in this analysis are: first-time or transfer student, High School Rank, Gender, Minority, Paid Deposit, SAT-Verbal, SAT-Math, High School Rank by SAT-V, High School Rank by SAT-M, Minority by SAT-V, and Minority by SAT-M. (In predicting the 1996 class, Gender by SAT-M and Gender by SAT-Verbal would be included). Both models predicted enrollment with greater success than the models used at May 1. Under 8% of the freshmen were classified incorrectly. While this is a significant model, under 40% of the freshmen who did not enroll were predicted correctly. Over 200 freshmen did not enroll and were predicted to enroll (the least desirable prediction). A more successful model was created by using the most

current year's data (1994) to predict for the upcoming fall (1995). This suggests that more information is needed about these students (e.g., financial aid packages, admissions contacts) to increase the utility of the model.

These analyses suggest that the college choice process is affecting the registration patterns of incoming freshmen. Some useful prematriculation variables are readily available as evidenced by these results. Also, more research is needed to examine the usefulness of prematriculation activity collected in other offices around campus. The following two sections explore these issues further.

Findings about Prematriculation Activities

The first prematriculation variable, the use of the enrollment deposit, has changed over the five years studied. Fewer students are paying the enrollment deposit by May 1, however, of the students who pay, a high percentage actually enroll. When using the enrollment deposit as an indication of commitment, actual fall enrollment can not be estimated with much confidence due to an increasing percentage of students who do not commit until July or August. Thus, using the enrollment deposit as a variable in the fall model did not contribute significantly. Also, predicting enrollment after the May 1 deadline was not very successful, however, the deposit did contribute in the FMR model.

The second prematriculation variable examined, time of initial registration, has also changed over the five years studied due to late-comers. A consistent majority of freshmen register during Freshmen Registration in July. Of the freshmen who do not pay the enrollment deposit (population 3), between 61% and 68% of the students register during Freshmen Registration (FMR). Of the freshmen who pay the deposit, approximately 88% register for classes during FMR. Across all the data, registering during FMR is consistently the most significant contributing variable to predicting enrollment in the fall. This is true even when traditional variables such as SAT scores, gender, etc. are included in the analysis as well. Predicting fall enrollment after FMR provides a more reliable model than after the enrollment deposit deadline. It will be important to monitor

registration at FMR in future semesters since a large percentage of the freshmen (30%-36%) that do not pay the deposit register in August. Overtime the percentage of students who register in August from this population (population 3) is increasing slightly.

Another prematriculation variable that shows some impact on predicting enrollment after FMR is the type of student (e.g., first-time freshmen or transfer). Despite the usefulness of this variable in predicting enrollment, it is not the most reliable data element due to the procedure for acquiring this data. Other studies that have discussed the reliability of this field suggest that the data should be utilized with caution. (For example, transfer course work typically isn't loaded onto the a student's record until later into the first semester.) However, if this model is maintained for pure predictive power, it is worth noting that the variable does have some merit in predicting matriculation.

The fourth prematriculation variable, registering as a full-time student or part-time student needs to be evaluated further. The nature of this analysis limited the usefulness of full/part-time status. This variable was not unique to the model, because of its relationship to enrolling at FMR. In this analysis, this variable did not contribute to the models, but analyses capitalizing on the continuous nature of this variable may reveal a relationship to enrollment. It may be interesting to examine the change in the number of hours enrolled at freshmen registration and the first week of classes.

The fifth consideration is the interaction of academic preparation and the prematriculation activity. SAT scores of students who commit and enroll are significantly higher than the SAT scores for students who commit but do not enroll and also students who enroll but do not make a commitment by May. One possible explanation for the lower SAT score of late-comers (population 3) is the high percentage of students for whom SAT scores are not available. This may be an artifact of processing freshmen in a limited amount of time (since they didn't pay the deposit by May) or it may take longer to reach a decision to accept/reject a student who does not have a complete application (no SAT scores), which means the student may not have had a decision from the university by May.

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SAT-Math scores did contribute to the 1992 and the 1995 FMR models. Interaction terms of SAT-M and SAT-V with High School Rank, Minority Status, and Gender were also significant variables across the models. The relationship between SAT scores and enrollment needs to be examined more closely in a follow-up study that controls for the change in the 1995 reporting of SAT scores as well as the admissions criteria for each semester. Preliminary analyses showed that SAT scores were significantly different over the five semesters.

High school rank was defined as either in the upper 30 percent or not in the upper 30 percent of the class. This variable did contribute to the models both by itself and as an interaction with minority, residency, and SAT scores. Students with a higher ranking are more likely to enroll. Further analyses are needed that change the ranking (e.g. to the upper 10 percent) to determine the usefulness of high school ranking at different cut-offs.

Further Research for Generating a Useful Model

Prematriculation behaviors available from other offices need to be reviewed for their usefulness as predictors of enrollment. Information about a student's unmet financial needs, the means of financial support (work study, grants, or loans) may be useful predictors at this early stage (particularly in May). Also, the admissions office has had various contacts with students at this juncture. Information concerning the number and type of contacts may be useful for this model. A system in development (STARNET) includes information about student academic progress, for Gradpact (an agreement between the school and the student to graduate within four years), may also be a useful resource for the model. These "outside" sources may provide more variables but also these sources may increase the base population. More information on the late-comers is needed; these students are in the data after they enroll, not before.

One variable not entered into these models was student enrollment during the summer. This information is generally known in mid-July and could be included in the analysis at that time. Many students who enroll in the summer are from special programs, (e.g., advanced college programs or first generation student programs). Further analyses will review this data element for its usefulness as a predictor of enrollment.

Conclusion

This study suggests that the college choice process is influencing the enrollment patterns of incoming freshmen, thus, affecting how and when to project enrollment. New variables that describe prematriculation behaviors can be added successfully to prediction models. These variables contribute towards predicting enrollment and can also be used to identify when the predictions may be most beneficial. Continuous evaluation of the college choice process, prematriculation behaviors and enrollment patterns may also provide unique insights into future retention and graduation rates.

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